Canadian Computer Algebra and Dynamic Geometry Systems in Mathematics Education Conference (CCADGME)


CCADGME participants

Computer algebra systems (CAS) and interactive geometry software applications are becoming more prevalent in school and university mathematics curricula. The CCADGME conference, held at Nipissing University during September 28-30, 2007, sought to address this reality through a unique combination of conversation and experience. The conference structure and registration were organized around two different tracks: one which involved Working Groups that examined issues of teacher practice and related research at the elementary, secondary, and post-secondary levels; and, a second involving a series of Technology Workshops which focused more on the exploration of a variety of CAS-based and interactive geometry software applications. Participants within both tracks shared common keynote speaker sessions, meals/refreshment breaks, as well as several technology and open discussion sessions during the weekend.

Keynote addresses were delivered by Zsolt Lavicza (Cambridge), Chantal Buteau (Brock), Walter Whiteley (York), Carolyn Kieran (UQAM), Nick Jackiw (KCP Technologies), Kate Mackrell (Queen's) presenting with Patrick St-Cyr (Cabrilog), and Nathalie Sinclair (Simon Fraser). Among the issues discussed during these talks were the following:

- Faculty beliefs and concepts relating to teaching with technology.
- Factors affecting shifts in departmental attitudes towards technology use within an undergraduate program.
- The importance of 2- and 3-D modelling, employing a combination of visual and kinaesthetic approaches in designing rich CAS-based tasks for secondary students.
- The use of dynamic geometry software in modelling discrete and continuous mathematics.
- The effectiveness of having young learners (K-8) model mathematical concepts and explore new ideas with technology.

Technology/software companies represented at the CCADGME conference included *Autograph*, *Cabrilog*, *Cinderella*, *GeoGebra*, *KCP Technologies*, *Maplesoft*, *Texas Instruments*, and *Wolfram*.

The conference website features a variety of resources made available by participants, as well as links to related technology sites dealing with Computer Algebra Systems (CAS) and interactive geometry software. Furthermore, at the time of this writing, streamed digital video recordings of the seven keynote addresses are also being prepared for public access via the conference website. See www.nipissingu.ca/ccadgme/index.htm

Technology in mathematics education may indeed possess rich potential for mathematical teaching and learning at all levels. However, this optimism must be continually tempered with legitimate concerns raised by colleagues from both mathematics and mathematics education. The CCADGME conference facilitated rich discussions surrounding these controversial yet significant issues which will no doubt continue to characterize, at least in part, the 21st century educational project.

"optimism must be continually tempered with legitimate concerns raised by colleagues from both mathematics and mathematics education"

CCADGME was organized by members of the Nipissing University Mathematics Education, Research, and Information Council (NUMERIC).

Daniel H. Jarvis (Nipissing)

CCADGME
First Canadian Computer Algebra and Dynamic Geometry Systems in Mathematics Education Conference

FIELDSNOTES

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Winter/Spring 2008 Thematic Program

HARMONIC ANALYSIS

Izabella Laba

HARMONIC ANALYSIS CAN BE DEFINED IN several different ways. It is often thought of as the study of the *Fourier series* of periodic functions, or the *Fourier transform* of more general functions on $\mathbb{R}^d$. Yet this description does not convey much sense of what type of questions harmonic analysis might address. This is how Yitzhak Katznelson explains it in the introduction to his Steele-prize-winning book:

Harmonic analysis is the study of objects (functions, measures, etc.), defined on topological groups. The group structure enters into study by allowing the consideration of the translates of the object under study, that is, by placing the object in a translation-invariant space. The study consists of two steps. First: finding the 'elementary components' of the object, that is, objects of the same or similar class, which exhibit the simplest behavior under translation and which belong to the object under study (harmonic or spectral analysis*); and second: finding a way in which the object can be construed as a combination of its elementary components (harmonic or spectral* synthesis*).*

Katznelson then goes on to say that "*the vagueness of the description [...] is due to the vastness of its scope*". Harmonic analysis can be done in a wide variety of settings. In number theory, the basic object of study is the set of integers $\mathbb{Z}$ and the `translations' are shifts by integers. In Euclidean harmonic analysis, we work with the space $\mathbb{R}^d$ equipped with the group of isometries. There is harmonic analysis on Lie groups and in finite fields. Applications of harmonic analysis range from abstract group theory to engineering and partial differential equations.

In the upcoming Fields Institute program in Harmonic Analysis, we will survey recent developments in harmonic analysis and its applications, including analytic and additive number theory, function and operator theory, harmonic analysis on Euclidean spaces, and applications to PDE theory. Although the range of the selected topics is quite diverse, there are common threads running through many of them: we are particu-

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2007 DISTINGUISHED LECTURE SERIES

UFFE HAAGERUP

The Invariant Subspace Problem is perhaps the most famous open problem in functional analysis. In its present form, it asks whether every bounded linear operator T on a separable Hilbert space $\mathcal{H}$ has a non-trivial invariant subspace, i.e., a subspace M of $\mathcal{H}$ such that $T(M) \subseteq M$. (The question was originally formulated with an arbitrary Banach space X in place of $\mathcal{H}$, and was shown to have a negative answer by Per Enflo in the 1970s.) Uffe Haagerup's Distinguished Lecture Series, held on November 6, 7, and 8, 2007, described his remarkable results, joint with Hanne Schultz, on a still harder problem than the usual Invariant Subspace Problem, namely, the invariant subspace problem relative to a factor.

A *von Neumann algebra* is a self-adjoint subalgebra of the algebra $B(\mathcal{H})$ of bounded linear operators on $\mathcal{H}$ which is closed in the strong operator topology (SO):

$$T_n \xrightarrow{(SO)} T \Leftrightarrow T_n\xi \to T\xi,\ \forall \xi \in \mathcal{H}.$$

If $\mathcal{M}$ is a von Neumann algebra whose centre consists only of scalar operators, then we say that $\mathcal{M}$ is a *factor*. Thus, $B(\mathcal{H})$ is a factor for any Hilbert space $\mathcal{H}$. The study of von Neumann algebras was initiated by Frank Murray and John von Neumann in the 1930s, and among their first results was the classification of factors into five types. Their classification is

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